



The sword and the knife: a comparison of Ancient Egyptian treatment of sword injuries and present day knife trauma.

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Abstract

The Edwin Smith Papyrus is the oldest known surgical treatise, thought to have been written in 1700 BCE. It was first discovered in Luxor in 1862 and was first translated from hieroglyphic script by Egyptologist James Henry Breasted in 1930. Unlike other Ancient Egyptian medical papyri that describe a combination of magical spells, incantations and herbal remedies to cure various ailments, the Edwin Smith Papyrus provides a pragmatic approach to treating predominantly traumatic injuries. The papyrus details 48 traumatic injuries, which are topographically organized and considered formulaically through examination, diagnosis, prognosis and treatment. Many of the injuries described can be directly attributed to trauma and this may explain the unusually practical approach to treatment.

The “khopesh” was an Ancient Egyptian sickle-shaped sword that was thought to have been used to inflict a slash-type sharp force injury during battle. Treatment of these slash-type wounds as described in the Edwin Smith Papyrus is compared with the treatment of equivalent slash-type injuries in the 21st century.

Comparison of a variety of components involved in the treatment of historical and modern slash-type sharp force wounds has illustrated that, despite advances in medical practice, some of the basic principles of our current treatment regimes are similar to practices established thousands of years ago by the Ancient Egyptians.

Keywords: slash wounds, khopesh, Edwin Smith Papyrus, Ancient Egyptian medicine, knife wounds.

INTRODUCTION

Throughout history, the continuous evolution of military and civilian weaponry has naturally prompted advances within medicine. Medics strive to develop new techniques to treat the injuries they encounter frequently and quickly develop expertise in these areas. The cases described within the Edwin Smith Papyrus illustrate that the Ancient Egyptians had developed practical techniques to treat surgical trauma. This is quite different from medical treatments of the time, which were rooted in magic and mystery. It seems the Ancient Egyptians had developed empirical knowledge in treating the many aspects of a traumatic injury and it is interesting to consider the relevance of this knowledge in the present day, considering the significant advances that have since been made in medicine. Has modern medicine evolved and distanced itself from the ancient treatments of previous years or are variations of historical techniques discovered thousands of years ago being used today? This article considers the use of the sword in Ancient Egypt, the wounds it could have caused and how they were treated, in comparison with modern day treatment of these wounds. It aims to discuss the similarities and differences between the current treatment regimes and Ancient Egyptian practices.

The sword in Ancient Egypt

The khopesh is a sickle-shaped Ancient Egyptian sword, often made from bronze or iron, and typically approximately 60 cm long.¹ It is thought that the khopesh was introduced into Egypt from Syria during the early New Kingdom period (c. 1550–1069 BCE)² and was thought to have been developed to combine the benefits of a sword and a battle-axe.³ The outside of the hook of the khopesh was sharp and it is understood that this would have been used as a single cutting edge.⁴ There are many depictions of warriors in battle with the khopesh raised above their heads (**Figure 2**), suggesting that it was used as a weapon for slashing the enemy.



Figure 1. An example of an excavated khopesh c. 1750 BCE. Image by Dbachmann, distributed under GNU Free Documentation Licence via Wikimedia Commons.(<https://commons.wikimedia.org/wiki/File:Khopesh.jpg>)



Figure 2. Ramses using the khopesh. Note the khopesh is raised above the Pharaoh's head, suggesting it will be used in a swiping downward manner and will inflict a slash-type wound to the enemy. Image from Art of Counting.⁵

Sword injuries in Ancient Egypt

Given the curved blade of the khopesh and its use for slashing the enemy, it would have most likely inflicted wounds that were deepest at their origin and most superficial where they terminate.⁶ The condition of the wound edges would depend on how sharp or blunt the sword was. The blunter the edge of the sword, the more likely that the wound edges would be ragged, abraded, bruised and the underlying tissue crushed; conversely, a sharpened edge would have produced a cut with neater edges as the soft tissues would be cleanly divided.⁷ These wounds were likely to extend deeply into the soft tissue and transect blood vessels

and, if enough force used, cut down to bone.⁷ It is likely that the khopesh would have inflicted a wound that would have bled profusely due to its sickle shape and the force with which it would have been used if it was brought down from above the warrior's head.

A slash-type incised wound caused by a knife in the 21st century is analogous to an injury caused by a khopesh during historical warfare, so this is taken as a point of comparison between historic Egyptian and modern day treatment for this type of injury. In this article, a slash-type knife wound is considered to be an incised wound where the tissues have been cleanly divided with no features of blunt force trauma, for example crushed tissue. However, it is noted that the features of a slash-type incised wound in both Ancient Egypt and modern day may vary according to how sharp or blunt the weapon was and the manner in which it was used.



Figure 3. An example of slash-type incised wounds. Note the origin of the incision is deeper and wider than the termination of the wound. Used with permission by Marc Smith, Wales Institute of Forensic Medicine.

The Edwin Smith Papyrus

The Edwin Smith Papyrus is an Ancient Egyptian papyrus and the oldest known surgical treatise, thought to have been written in 17th century BCE. It was discovered in Luxor in 1862 and was first translated from hieroglyphic script by Egyptologist James Henry Breasted in 1930.⁸ The papyrus describes 48 traumatic injuries arranged according to body area and from head to toe. It is understood by Sigerist to be a surgical manual written to instruct other surgeons.⁹ The cases

in the papyrus are described in a surprisingly pragmatic manner considering the strength of the Ancient Egyptian belief in magic, the role of deities in afflicting disease¹⁰ and the use of magical spells and incantations as either medical treatments in themselves or as adjuncts to increase the effectiveness of other medical treatments.¹¹ The traumatic nature of the injuries described in the Edwin Smith Papyrus may explain this unusually practical approach. Each case in this papyrus is considered in a logical, formulaic arrangement, beginning with the provisional diagnosis (given as the title of each case), through to examination, diagnosis, prognosis and treatment.¹² Within the literature, various aspects of the Edwin Smith Papyrus have been discussed, ranging from analysis of individual cases¹³ to articles that consider the treatments of different medical conditions, including otorhinolaryngology,¹⁴ urology¹⁵ and orthopaedic cases.¹⁶ This article contributes to the discussion by examining the treatment and complications arising from a slash-type incised wound as described within the Edwin Smith Papyrus and in modern medical literature.

METHODOLOGY

This article reviews selected cases within the Edwin Smith Papyrus that describe aspects and sequelae of traumatic injuries that are interpreted as being consistent with injuries that could have been caused by a khopesh. The description of each injury and treatment methods described within the papyrus are analysed to piece together the fundamental ancient techniques used to treat traumatic incised slash-type injuries. The ancient treatment methods are then compared to analogous modern day treatments of a similar injury to enable comparison of ancient and modern treatments of traumatic incised slash-type injuries. International public health guidance and recent medical research published within the field of trauma management are used as modern standards for treatment.



Incised wounds

The majority of injuries described in the Edwin Smith Papyrus relate to traumatic head and upper limb injuries. Given the diverse management of slash-type wounds depending on their anatomical location, a comparison between historical and modern head and upper limb injuries is considered.

Out of the 48 cases described in the papyrus, there are 13 cases that may relate to incised wounds. Breasted suggests that the papyrus differentiates between the character of the wounds (*webnu*) described in the papyrus. He notes that there is a type of wound described with a *webnu* of a gash, which he interprets as being a gaping wound.¹⁷ Breasted suggests that these gashes are wounds that could have been inflicted by a sword, knife or battle-axe¹⁷ and, therefore, can be interpreted as incised slash-type wounds.

Wound cleaning

Case 14 in the Edwin Smith Papyrus describes a wound in the nostril and its subsequent treatment. This has been translated as “thou shouldst make for him two swabs of linen, (and) thou shouldst clean out every worm of blood which has coagulated on the inside of his nostril”.¹⁷ This illustrates that the Ancient Egyptians practised cleaning a traumatic wound by removing coagulated blood before beginning any other treatment.

This compares to the modern day approach to dressing a wound, where it is advised that the wound should be cleaned using saline and that “a wet cotton swab [should be used] to loosen and remove any blood or crust that forms”.¹⁸ Clearly, this practice of cleaning the wound and removing any coagulated blood was a crucial step in wound management in Ancient Egypt and remains so in modern medicine.

Wound closure

There are seven cases of wounds in the Edwin Smith Papyrus that the author recommends should be stitched. The majority of these relate to injuries on the

head, such as wounds to the ear flesh, above the eyebrow, to the lip, and one case to the shoulder. If the stitching fails, “thou shouldst draw (it) together for him with two strips (of plaster)” using adhesive plaster to close the wound.¹⁷ Suturing is a surgical technique used frequently in modern medicine to close many different types of wounds, ranging from superficial lacerations to deep surgical incisions. Bringing the edges of the wound together and suturing them facilitates quicker wound healing by enabling faster platelet aggregation and enabling haemostasis to be achieved more rapidly. It avoids prolonged exposure of the underlying structures and prevents infection by stopping bacteria from entering the wound.¹⁹

The Edwin Smith Papyrus is not specific about the technique of suturing but, in modern medicine, the suture technique would depend upon the depth of the laceration. Horizontal mattress sutures are suggested by Forsch for closing gaping wounds²⁰ and so perhaps this may have been most appropriate for closing an incised wound similar to one caused by a *khopesh*.

The general technique of closing a wound and then dressing it has changed little from the Ancient Egyptian practice, except for our modern day use of anaesthesia, and antibacterial preparation of the site and post-procedure antibiotic cover if the wound has been open for longer than eight hours or appears contaminated. These modern practises have originated from medical advancements in microbiology and pharmacology, but the basic principles of closing a gaping wound with sutures remains the same.

Suturing is clearly a surgical technique and the didactic tone of this surgical papyrus suggests that some surgery was practiced in Ancient Egypt. No surgical instruments have survived from the time (aside from flint blades used to cut the umbilical cord²¹) and there is little evidence of major surgery on any of the mummies examined.²² However, evidence suggesting that some surgery was performed in Ancient Egypt includes iconographic depictions of circumcision²³ (**Figure 4**), controversial dental surgery²⁴ and orthopaedic amputations,²⁵ including one case where a

big toe was amputated and replaced with a wooden prosthesis.²⁶

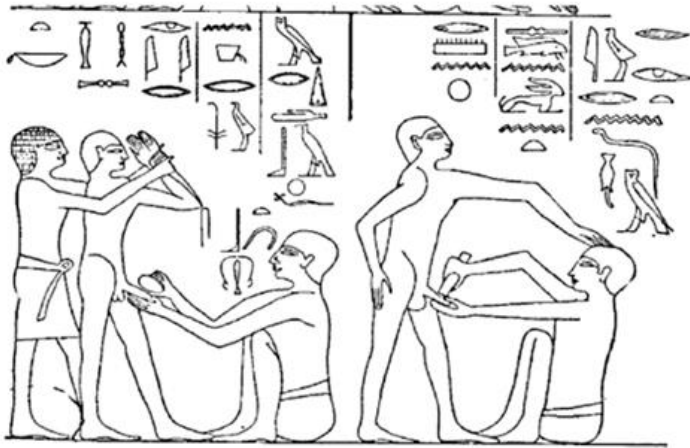


Figure 4. A depiction of circumcision in ancient Egypt.²⁷

Case 41 in the Edwin Smith Papyrus describes a patient with “a diseased wound in his breast”.¹⁷ The author advises that “while that wound is inflamed and a whirl of inflammation continually issues from the mouth of that wound at thy touch; the two lips of that wound are ruddy, while that man continues to be feverish from it; his flesh cannot receive a bandage” (and presumably also it cannot take sutures).¹⁷ Leaving an infected wound open and not suturing it is in line with modern principles of wound management. The World Health Organization advocates leaving infected wounds open, to dress and clean them regularly and to leave them to heal by secondary intention.²⁸

However, the specific time frame involved in the management of these wounds is not adequately described in the papyrus so it is difficult to draw comparisons between treatment methods. The technique of modern day wound closure depends predominantly upon the history of the injury and the duration of time since the injury occurred. A clean wound less than eight hours old is advised to be closed by primary suture as described in the papyrus; however, an injury over eight hours old cannot be closed as “it must be assumed that any potential

infection has become established”.²⁸ In contrast, the only gaping wounds that are not closed in the papyrus are those which are visibly infected, such as this diseased breast.

Use of anti-inflammatories

Interestingly, the author of the papyrus advises the application of “leaves of willow” to be applied to the infected breast wound for treatment of the inflammation and infection.¹⁷ The use of substances derived from willow, including its leaves and bark, are mentioned in the Ebers Papyrus, where it is advised for the relief of inflammation and pain.²⁹ Acetylsalicylic acid, commonly known as aspirin, is found in naturally high concentrations in willow.³⁰ Aspirin is used regularly in modern medicine as an analgesic, antipyretic, anti-inflammatory and antiplatelet medication, which lowers the viscosity of blood and therefore can be used postoperatively for prevention of thromboses. The mechanism of action of aspirin is the inhibition of the cyclooxygenase enzyme, which prevents the formation of prostanoids that are involved in inflammatory processes. Hence, aspirin is used to treat inflammation and pain. Clearly, the empirical observations made by the Ancient Egyptians about substances derived from willow were significant enough for it to be used regularly for its anti-inflammatory mechanisms in treating infection.

Achieving haemostasis

Many of the soft tissue injuries described in the papyrus are treated initially on the first day of injury with application of freshly slaughtered meat bound to the wound with linen: “thou shouldst bind fresh meat upon it the first day; thou shouldst apply for him two strips of linen”.¹⁷ Strouhal suggests that this meat is rich in blood and could provide various biological agents such as vitamins, antibodies and hormones to enhance wound healing.³¹ Nunn explains that fresh meat can provide clotting factors and these may activate the body’s innate coagulation cascade. This



technique was in fact used by surgeons in 1975 to control the oozing of blood during surgery.²¹ Therefore, the Egyptian method of placing fresh meat on a wound can be seen as a haemostatic agent preventing further blood loss and aiding wound healing.

In modern treatment, direct pressure is usually applied to a wound to induce vasoconstriction and clot formation. Depending on the extent of the haemorrhage, Adams and Hamblen recommend firmly bandaging the wound to control blood loss,³² but if arterial pulsatile bleeding occurs then firm pressure should be applied and the limb elevated with a tourniquet applied.³³ Depending on the extent of the bleeding, the patient should be assessed for haemorrhagic shock and should be transfused cross-matched blood (if available), blood substitutes or plasma expanders to replace the lost blood volume.³² Clearly, a blood transfusion would not have been an option in Ancient Egypt so it is likely that a patient suffering from severe arterial bleeding and haemorrhagic shock would have died.

Direct pressure is often enough to control non-arterial bleeding. However, in some instances, for example in patients with a genetic clotting dysfunction such as haemophilia, additional haemostatic agents can be used in addition to other methods in order to achieve haemostasis. These agents include adrenaline, thrombin, fibrin sealant and alginate dressings.³²

This concept of using haemostatic agents to prevent blood loss is remarkably similar to the Ancient Egyptian practice of placing fresh meat onto the wound.

Wound dressings

Strouhal argues that treatment with linen, oil and honey was considered standard wound dressing for soft tissue injuries in Ancient Egypt as it is recommended in 30 out of the 48 cases in the Edwin Smith Papyrus.³¹ Linen was used for its absorptive properties, which is useful in drawing moisture and lymph away from the wound; it was considered the

cleanest cloth they could have used and was the cloth of choice used in the mummification process.³⁴ Oil was often used to act as a barrier and as an unguent as it was considered to have a soothing effect on wounds.³⁴ Honey was used extensively throughout Egyptian medicine and was applied both externally to wounds and administered internally as medicine. The majority of the wounds described in the Edwin Smith Papyrus describe dressing wounds with honey. Honey is a mixture of glucose and fructose and has an osmotic effect due to its high concentration of sugar, drawing lymph out of the wound and thus reducing swelling and inflammation.²¹ Honey is also bacteriostatic and the Egyptian technique of applying honey to wounds is still used in modern medicine. A recent study noted that the application of honey of various forms to wounds, including as a gel, impregnated dressings and ointments had several beneficial effects. It improved healing time and exhibited antimicrobial, debriding, anti-inflammatory and antioxidant activity.³⁵ Seckham and Cooper describe how relatively low concentrations of honey are able to inhibit the activity of many Gram-positive bacteria that are most often responsible for wound infections, most notably *Staphylococcus aureus*, the most common bacteria in wound infections, and methicillin-resistant *Staphylococcus aureus* (MRSA).³⁵

Molan summarizes his clinical observations following the treatment of various wounds with honey as follows: "infection is rapidly cleared, inflammation, swelling and pain are quickly reduced, odour is reduced, sloughing of necrotic tissue is induced, granulation and epithelialisation are hastened, and healing occurs rapidly with minimal scarring".³⁶ He also found that the application of honey to a wound prevented dressings from sticking to the wound, which significantly reduced the patient's discomfort when they had their dressings changed. It seems likely that although the Ancient Egyptians would not have understood the mechanisms by which honey enhanced wound healing, empirical evidence was so significant that the application of honey became a standard wound dressing technique and one which remains in current



medical practice for the treatment of infected and/or complex wounds.

Treatment of fractures

As well as causing a potentially devastating flesh wound, a blow from an Egyptian khopesh could have potentially caused fracture of the bone if it had been used with enough force. Complete transection of the bone would have been unusual; a strong enough force would have likely caused a comminuted, compound or closed fracture, or chip part of the bone away. The Edwin Smith Papyrus describes several incidences of reducing a fracture:

“If thou examinest a man having a break in his upper arm, (and) thou findest his upper arm hanging down, separated from its fellow [...] thou shouldst place him prostrate upon his back, with something folded between his two shoulder blades; thou shouldst spread out with his two shoulders in order to stretch apart his upper arm until the break falls into place. Thou shouldst make for him two splints of linen, (and) thou shouldst apply for him one of them both on the inside of his arm, (and) the other of them both on the under side of his arm”.¹⁷

This is a very clear description of reducing and splinting a fracture and splinting which would allow the fracture to heal in the correct anatomical position. Modern day fracture treatment involves the practically unchanged process of anatomically reducing the fracture fragments, followed by either external fixation in a cast or external fixation device, or alternatively with internal fixation with plates, screws, wires or rods. This fixation stabilizes the fracture and enables it to heal. As Ellis notes, the procedure described in the papyrus is remarkably similar to modern day treatment of a similar injury,³⁷ illustrating that the technique remains the most effective way of treating this type of fracture.

In current medical practice, fractures are either reduced by closed manipulation, mechanical traction or via open surgery. Closed reduction is usually performed under anaesthesia and involves grasping the two fractured ends of bone and realigning them into their anatomical position. This is the same procedure described in the papyrus. Mechanical traction involves applying weights to realign the fracture fragments and is used particularly with fractures of long bones, for example femoral shaft fractures where the muscles exert a strong displacing force.³² This can be done gradually via prolonged traction or alternatively in one sitting under anaesthesia.³² Clearly, the current treatment of closed fractures and the Ancient Egyptian treatment of closed fracture reduction are very similar, demonstrating how little this technique has changed.

CONCLUDING COMMENTS

It seems clear that when the individual elements involved in treatment of a slash-type incised wound are examined, there are many similarities between Ancient Egyptian and modern treatment. The fundamental steps in each approach are essentially the same and only differ either where there is limited detail in the historical description or where there have been significant advances in modern medicine. The Ancient Egyptians were limited by the macroscopic examination of a wound, whereas advances in scientific technology and techniques (for example microscopy) have increased our understanding of the physiological and pathological mechanisms underlying an injury and have hence influenced our treatment.

The Edwin Smith Papyrus describes mostly traumatic injuries, many of which may have been clearly attributed to a sharp blade rather than a mysterious or magical cause. The overt nature of these injuries encourages a practical approach to their management. The treatments described in both ancient and modern medicine are logical, rational and rooted in empiricism. The Edwin Smith Papyrus reveals the extent of Ancient Egyptian knowledge and



accumulated experience in treating these injuries and many of our modern treatment standards rely on evidence-based medicine that is often derived from initial empirical observations. This common source of empiricism may explain the similarities in ancient and modern treatments, given that the ancient techniques of coagulation using haemostatic agents, suturing gaping lacerations, the use of acetylsalicylic acid for pain relief and antibacterial dressings with honey are also features of modern medicine.

Given the similarities in treatment, it is interesting to consider what influence Ancient Egyptian practices had on the development of modern techniques. It is possible that Ancient Egyptian knowledge had been directly passed on and that our current practices are derived from theirs and refined by technological advances. However, it seems more likely that the Egyptian knowledge and practices were lost and independently discovered at a later date. French barber-surgeon, Ambroise Paré, is largely credited with giving rise to “a revolution in surgical techniques” in 1537 by only performing treatments that he had actually observed to be useful.³⁸ Paré challenged the traditional, theoretical, Galenic-based medicine which had been the crux of medicine since the second century.³⁸ This suggests that the Ancient Egyptian knowledge was rediscovered independently later through practical observation, experience and empirical analysis. Clearly, many of the Ancient Egyptian treatments of wounds were actually rather successful despite their limited understanding of anatomy and physiology, as their techniques are used in modern medicine over 5000 years later.

Competing Interest and Funding

Nothing to declare

What is known already:

- How diagnosis and treatment of spinal injuries in the Edwin Smith Papyrus compares with modern treatment
- How urological cases are treated in Ancient Egypt in comparison to present day
- How traumatic head injuries were treated in Ancient Egypt
- How early attempts at plastic surgery are described within the Edwin Smith Papyrus
- How ENT surgery developed in Ancient Egyptian surgical practice

What this study adds:

- Reviews the cases within the Edwin Smith Papyrus focusing on management and complications arising from a slash-type incised wound
- Identifies techniques derived from Ancient Egyptian medicine and how they are used in modern medicine
- Discusses how modern treatment of a sharp force wound differs from the Ancient Egyptian practice and considers the reasons why

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